Modeling Drinking Water Lead Exposure from Premise Plumbing
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Impact Statement

This presentation discusses the validation of a new modeling approach for predicting lead exposure from premise plumbing sources, and incorporates variability due to different plumbing materials, water-using fixtures, water usage patterns, and water chemistry. This project is a part of the efforts under Homeland Security Research Program (HSRP 7.53 & HSRP 7.45) and the Safe and Sustainable Water Systems Research Program (SSWR 6.02).

Background

Exposure to lead from drinking water in homes or buildings can be harmful to human health because lead is a neurotoxin. The amount of lead people in the home are exposed to depends on the lead sources, plumbing materials and sizes, types of water using fixtures, water chemistry, and water usage patterns. Currently, there is no good way to predict lead exposure because sampling methods do not capture water consumption patterns under typical household use.

Study Description

A home plumbing system simulator was installed in NRMRL's Cincinnati laboratory in 2012 and has been used in an ongoing study of metal corrosion and *Legionella* occurrence. This system was designed to replicate a small home with 4 faucets, 1 shower, and 1 toilet, it uses lead solder used one branch and 40-gallon hot water heater. A lead service line was installed in 2016 and a random daytime use pattern was implemented. Water samples have been collected over a one-year period, and were used to validate a new model of the hydraulics and water quality within a home or building.

Results

This study found that there was a generally good agreement between the model and data from the home plumbing simulator for sequential and fixed length stagnation samples. One source of error in the model is related to the dispersion of lead throughout the plumbing system which is not captured by the

model. Particulate lead v was not captured in the model, but there was a possibility particulates were present in the samples. Modeled concentrations under flowing conditions were generally lower than observed flowrates.

Conclusion

In order to be used for the purpose of modeling lead concentration in homes, the EPANET model code will be updated to incorporate the effects of dispersion and to add particulate lead modeling capability. It will also expand to include Monte Carlo study to allow for prediction of individual exposure to lead.

Partners engaged

This project was conducted by NRMRL, with consultation from staff in NHSRC, NERL and OW.

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